Skeletal Trauma Fractures: The Basics

a quick-hit lecture series based on content from...
Essentials of Orthopedic Surgery Fourth Edition
Orthobullets
Amboss
Radiopaedia

presented by Underground Ortho

Major types of skeletal trauma

Fractures

- Disruption in continuity of cortical or cancellous bone

Dislocation

- Disruption normal articulating anatomy of joint
- Can be complete or partial
- Termed subluxation when partial

Fracture dislocation

- Fracture occurring in or near joint that results in subluxation or dislocation of joint

Soft tissue involvement

Closed

- Bone and/or soft tissue non-contiguous w/external environment
- Skin barrier is intact overlying fracture site

Open

- Bone and/or soft tissue contiguous (exposed) to external environment
- Skin barrier is disrupted overlying fracture site
- Increased risk of infection and neuromuscular injury cf closed fracture

Fragmentation

Simple

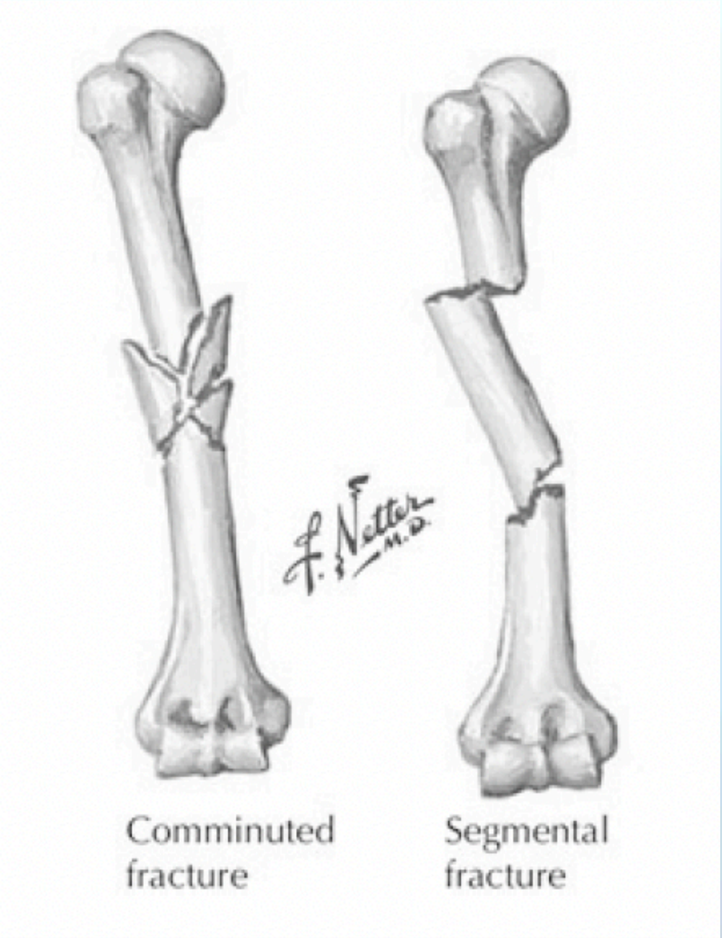
- Proximal and distal portions of bone split by one fracture line

Segmental

- Proximal and distal portions of bone with interspaced bone fragments, resulting in two fracture lines

Comminuted

- >1 bone fragment with >2 fracture lines



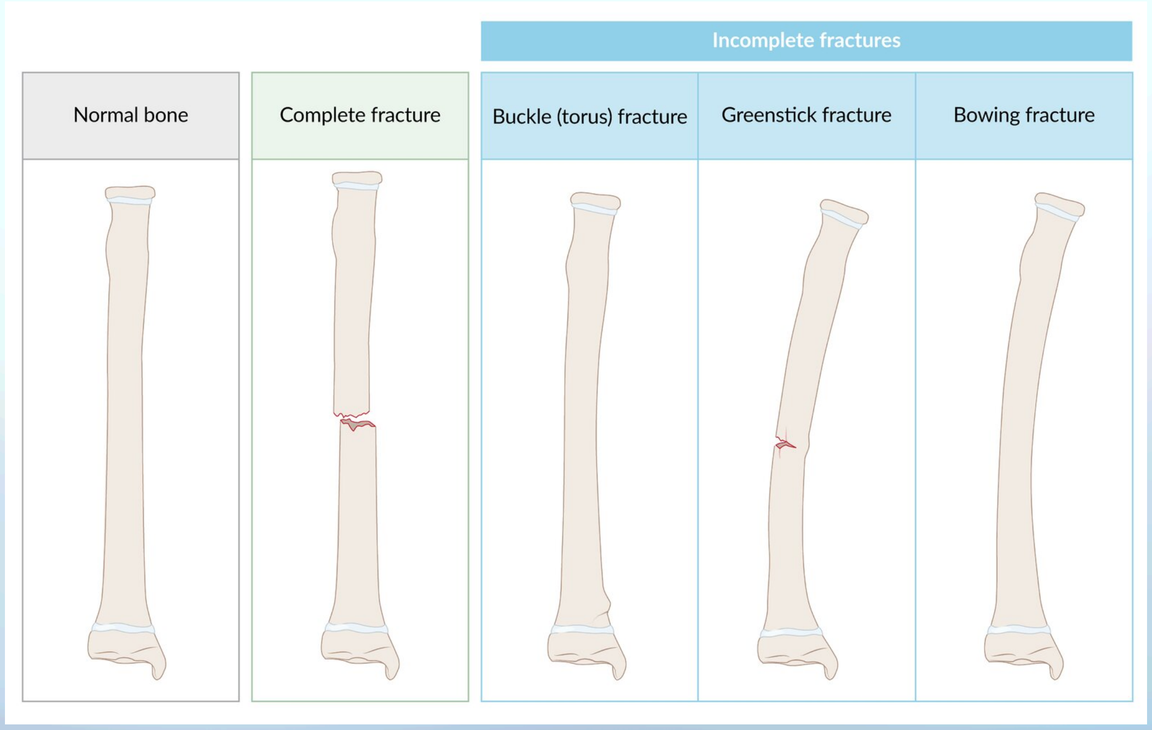
Extent

Complete

- Fracture line completely transects bone (ie extends across both cortices)

Incomplete

- Fracture line absent or does not transect entire width of bone (ie involves neither or only one cortex)
- Most typically seen in children due to greater elasticity of growing bones and thicker, stronger periosteum



Characteristics of incomplete fractures [1][2]

Type of incomplete fracture	Radiographic findings	Most common site	Treatment
Buckle fracture (torus fracture)	• Disruption of the cortex on the side of the compressive force (**concave side**), which appears as a bulge • The convex side is intact. • Mild or no angulation at the fracture site	• Distal radius and/or ulna at the junction of the metaphysis and diaphysis	• Immobilization with a splint or a cast for 3–4 weeks
Greenstick fracture	• Disruption of the cortex and periosteum on the side of tension (**convex side**) with an intact periosteum and cortex on the side of compression (concave side) • Some degree of angulation is usually present.	• Diaphysis of the radius, ulna, or fibula	• Acceptable angulation*: immobilization with a cast • Greater than acceptable angulation: closed reduction followed by immobilization with a cast
Bowing fracture	• No disruption of the cortex or periosteum • Angulation is present.	• Diaphysis of the ulna (most common) or fibula	

Deformity

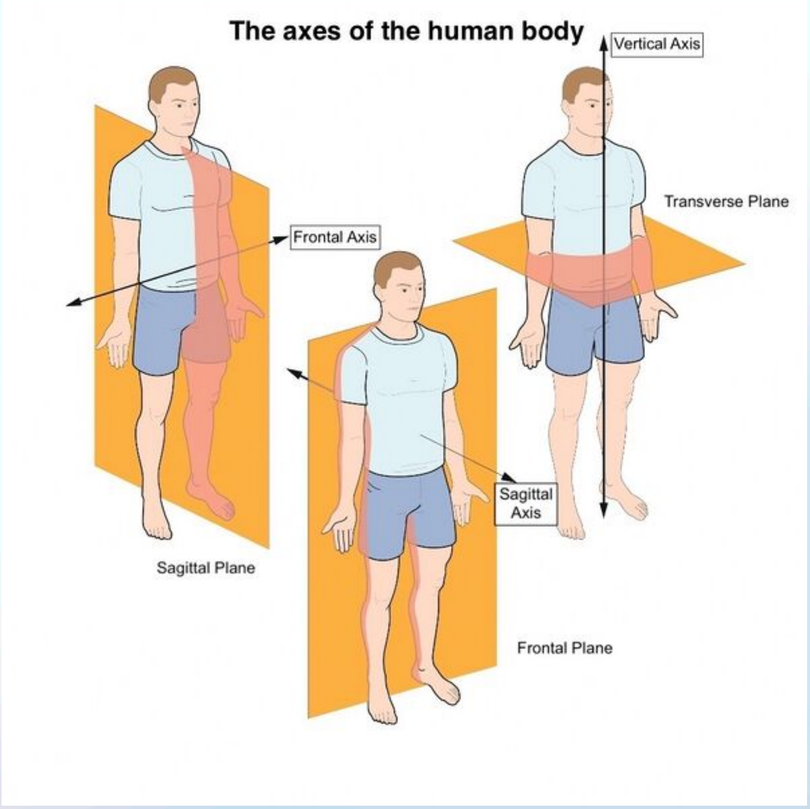
- Deformity can occur in up to three planes, and about the longitudinal axis
- Traditionally deformity described by distal portion position relative to proximal portion
- Displacement is the opposite of apposition

Translational displacement

- In medio-lateral (or sagittal) plane, or
- In antero-posterior (or coronal/frontal) plane

Longitudinal displacement

- In transverse (or horizontal) plane



- Impaction (shortening): results in decrease in overall length of fractured bone
- Distraction (lengthening): results in increase in overall length of fractured bone

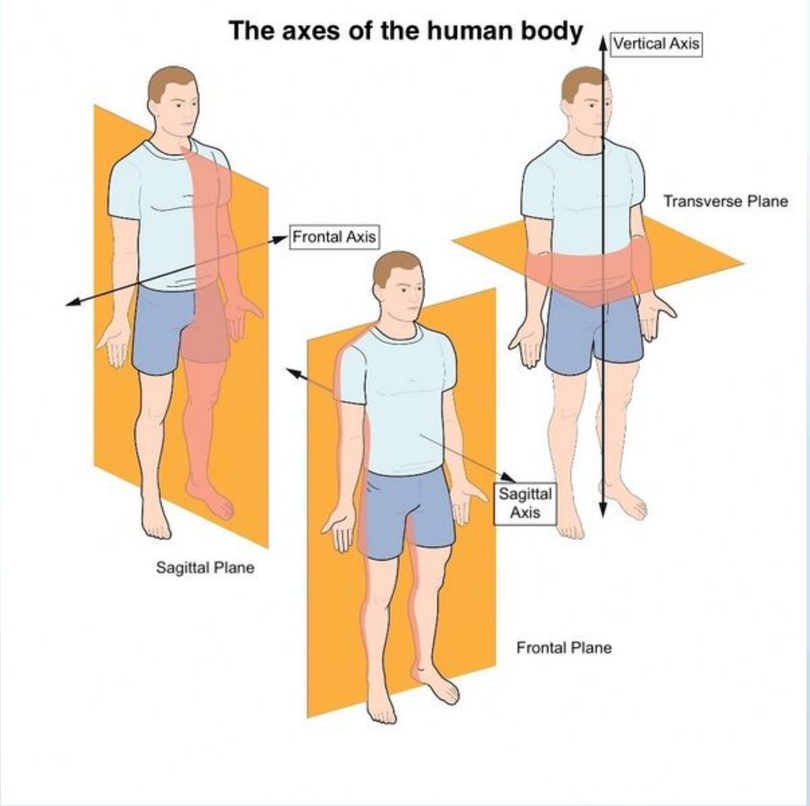
Deformity

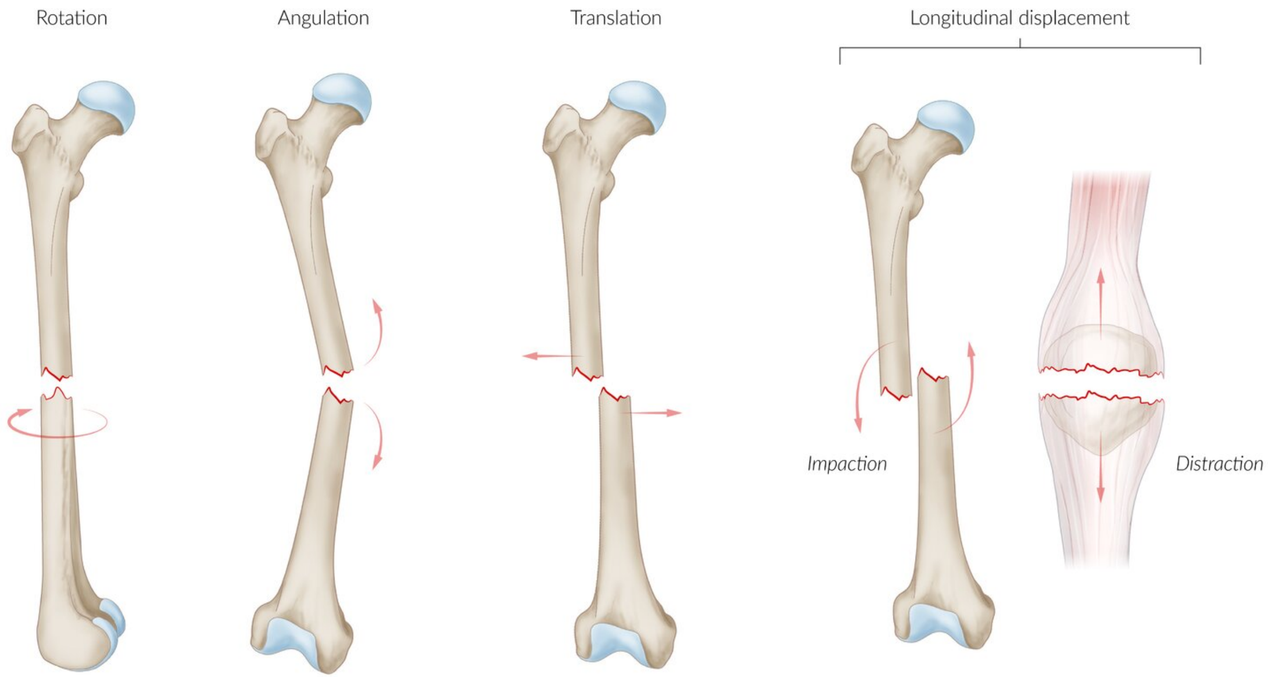
Rotation

- About the longitudinal (or vertical) axis (ie orthogonal to the transverse plane)
- Not observed in sagittal or coronal axes (ie orthogonal to coronal and sagittal planes, respectively)

Angulation

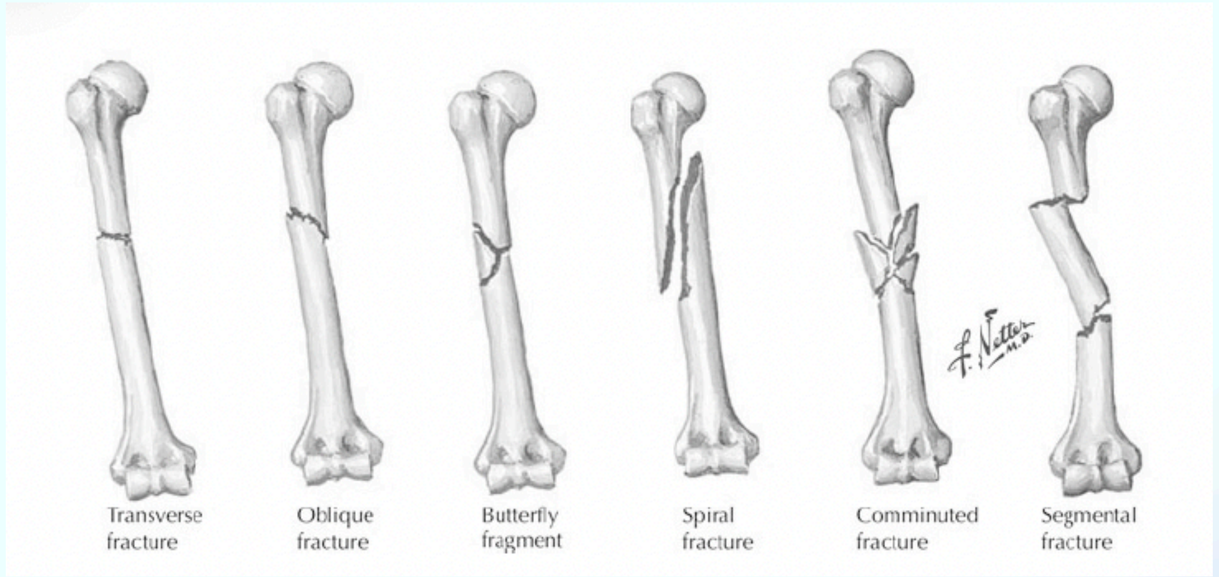
- Results in distal portion with new vector components relative to proximal portion (or existing in more than one plane relative to the proximal portion)
- Described in direction fracture apex faces (apex opposite compressive force, ipsilateral tensile force)




Rotation
Angulation
Translation
Longitudinal displacement
Impaction
Distraction


A
Valgus angulation
Varus angulation
Anterior angulation
Posterior angulation
B
Shortening
Translation

Pattern



Transverse

- Result of bending loading
- Fracture line <30°

Impacted

- Result of axial loading
- Proximal and distal portions driven into each other
- Typically referred to as compression fracture at level of vertebrae

Oblique

- Result of combined bending + axial loading
- Fracture line ≥30°

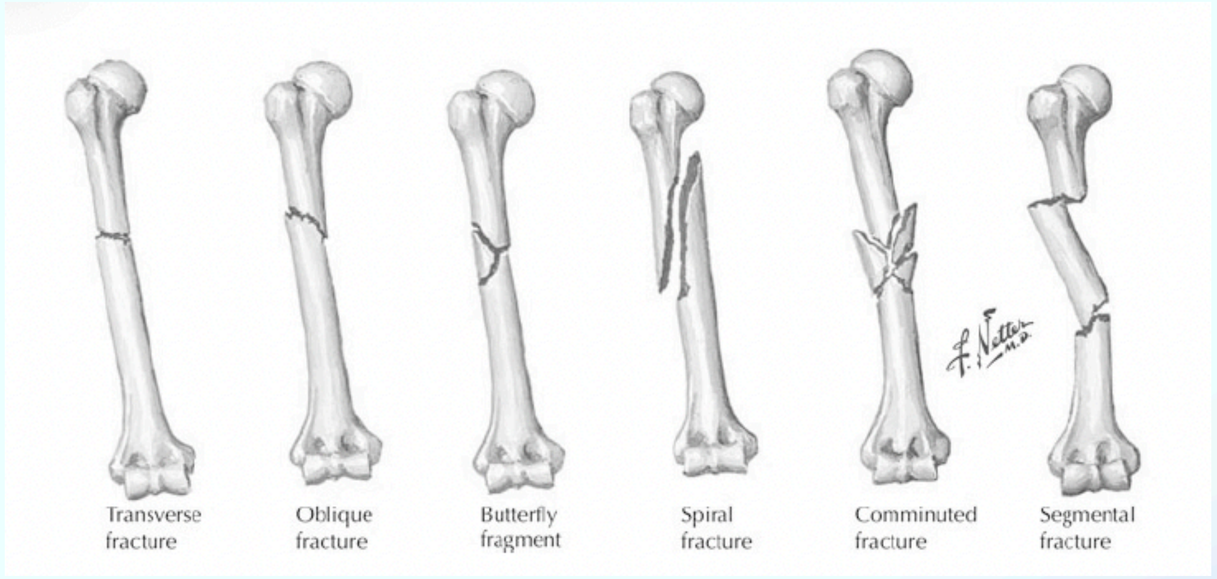
Pattern

Spiral

- Result of torsional loading

Avulsion

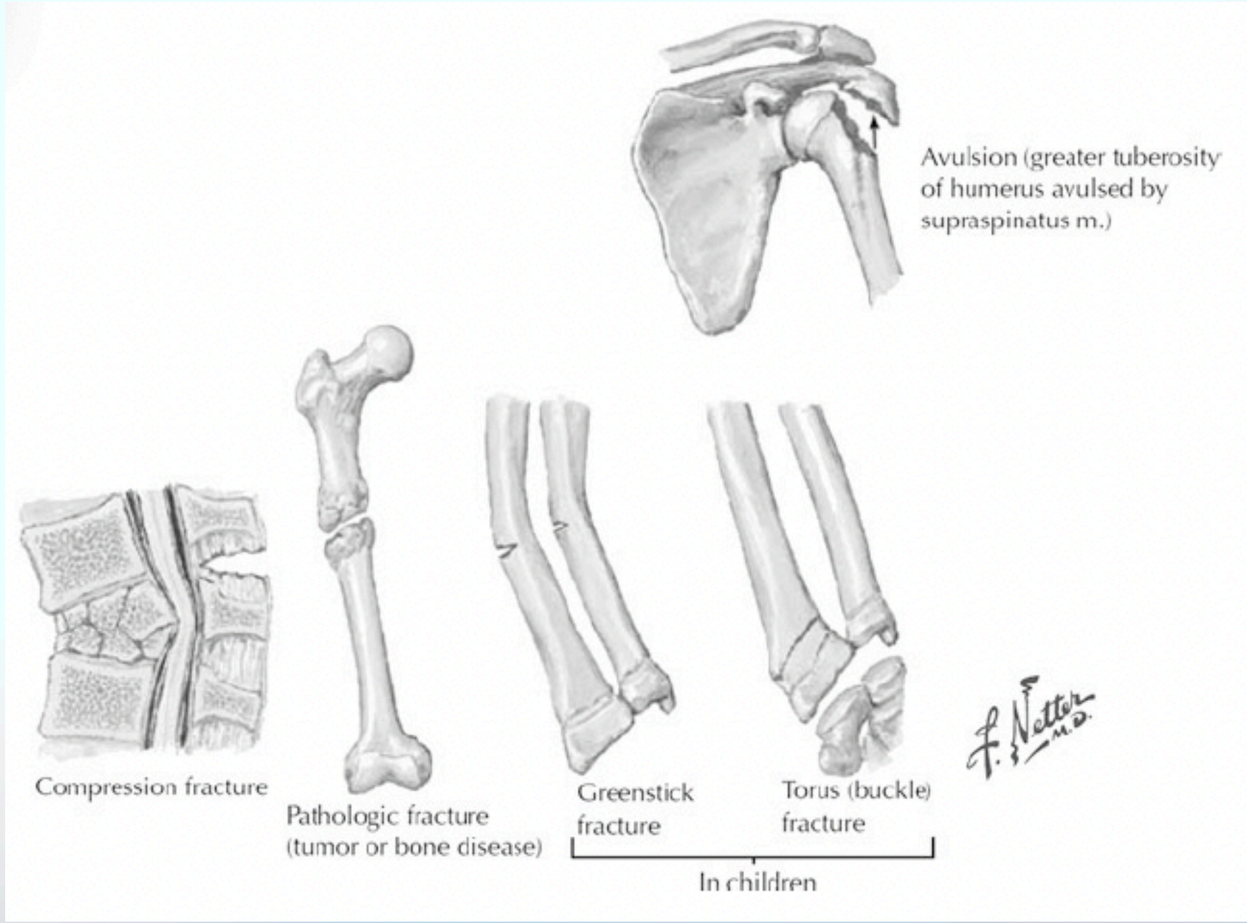
- Result of tensile loading
- Proximal or distal portion avulsed or ripped away from cognate portion due to tensile or pulling force



Classic fracture types

Stress

- Result of repetitive loading
- Any single load insufficient force to cause fracture (may cause micro-fracture), accumulated stress sufficient to cause fracture
- May be defined as any single load being below the endurance limit. This is not equivalent to the above statement, and also not the case.
- Endurance (or fatigue) limit: the stress range below which there is no crack growth and the material presents an infinite life under cyclic stresses.



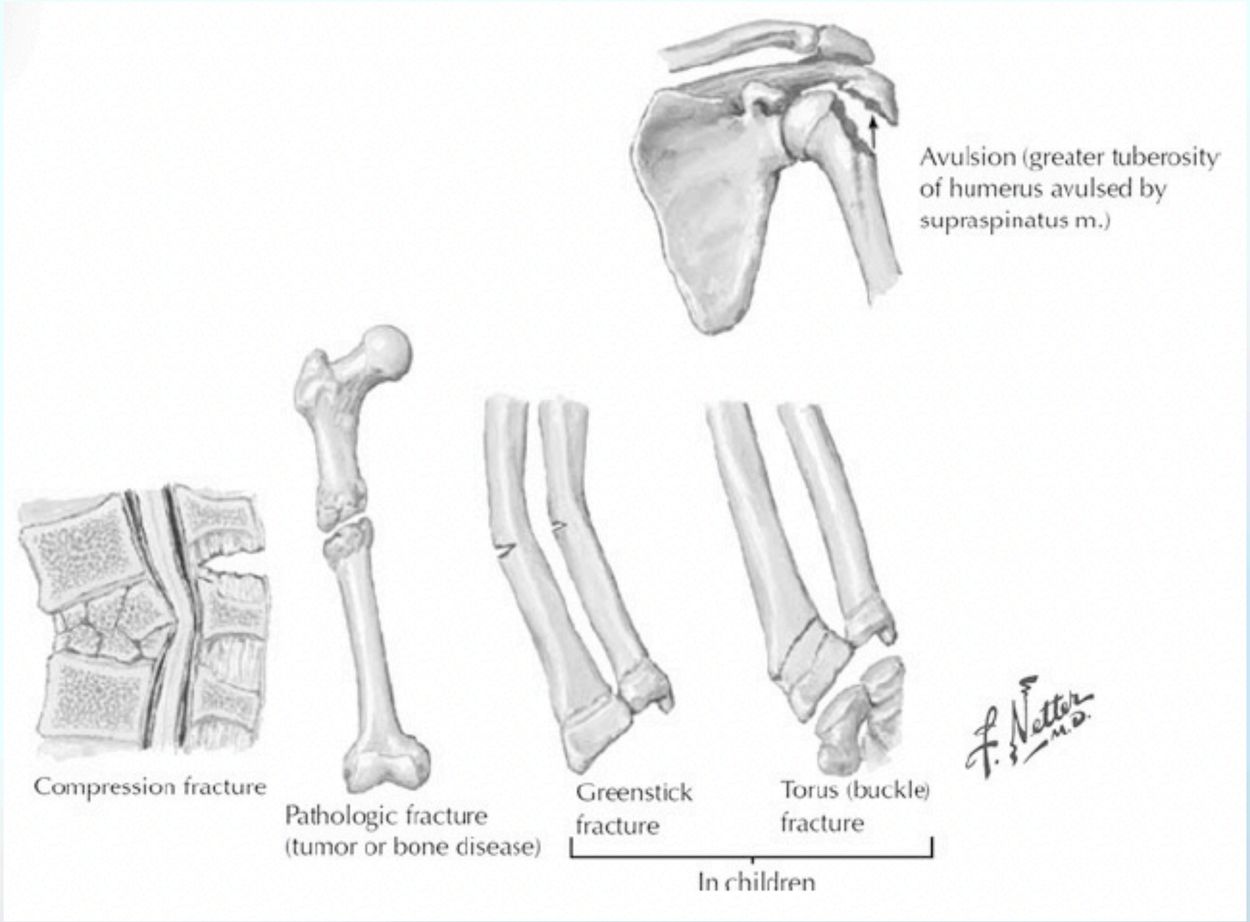
Classic fracture types

Pathologic

- Result of abnormal bone weakness 2/2 to underlying condition
- Precipitated by minor trauma (cough, sneeze) or spontaneously

Intra-articular

- Result of disruption of joint surface and articular cartilage



Physeal fractures

- Fracture through growth plate (only occurs in paediatric population)
- Characterized by **Salter-Harris classification** system
  - Type I: transverse physeal fracture, separating epiphysis from metaphysis
  - Type II: transverse physeal + metaphyseal fracture
  - Type III: transverse physeal + epiphyseal fracture (intra-articular fracture)
  - Type IV: physeal + metaphyseal + epiphyseal fracture (intra-articular fracture)
  - Type V: physeal impaction